

***IN THE UNITED STATES PATENT AND TRADEMARK OFFICE***

Applicant: Nicholas AYACHE et al  
Title: APPARATUS FOR SIMULATING  
THE DEFORMATION OF  
MATERIALS, NOTABLY OF SOFT  
BODY TISSUES  
Appl. No.: Unassigned  
Filing Date: 02/04/2002  
Examiner: Unassigned  
Art Unit: Unassigned

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to examination of the above-identified application, Applicant respectfully requests that the following amendments be entered into the application:

**IN THE CLAIMS:**

In accordance with 37 C.F.R. § 1.21, please substitute for original claims 3-5, 8, 10, 12 and 14 the following rewritten version of the same claims, as amended. The changes are shown explicitly in the attached "Version With Markings to Show Changes Made".

3. (Amended) Apparatus according to claim 1, characterised in that, for an object of solid three-dimensional shape, the grid pattern chosen is tetrahedral, so that the computer is able to estimate the composition of the forces at each vertex of the tetrahedron, as a function of the deviation between the current length of each edge of the tetrahedron and the length of this edge at rest.

4. (Amended) Apparatus according to claim 1, characterised in that the computer is adapted to determine differences between the squares of the current length

(Ij) and the preceding length and/or the length at rest ( $L_j$ ) of each edge in order to determine said composition of forces.

5. (Amended) Apparatus according to claim 1, characterised in that the memory zone is adapted to store, in association with each mesh, mechanical parameters of the material of the mesh ( $\lambda_n, \mu_n$ ), at least partially defined locally, particularly at the level of the mesh or elements thereof.

8. (Amended) Apparatus according to claim 1, characterised in that it comprises a module for developing a data structure and adapted to delete mesh sides or edges ( $A_i$ ) which connect two so-called "virtual" vertices ( $S_i$ ).

10. (Amended) Apparatus according to claim 1, characterised in that the module (30, 32, 36) adapted to determine the new positional data of the vertices ( $Q'_n$ ) as a function of the composition of forces at each vertex, is adapted to determine said new positional data as a function of time (E3), which makes it possible to follow the evolution of the respective positions of the vertices over time.

12. (Amended) Apparatus according to claim 1, characterised in that the computer is capable of repeatedly determining the positional data of the vertices of the grid, with a view to determining the evolution of said positions over time ( $t + \Delta t$ ).

14. (Amended) Apparatus according to claim 1, characterised in that it comprises a user interface (IU) provided with a handling device (CLA, MO) for simulating one or more forces exerted globally on the subject.

**REMARKS**

Applicants respectfully request that the foregoing amendments to Claims 3-5, 8, 10, 12 and 14 be entered in order to avoid this application incurring a surcharge for the presence of one or more multiple dependent claims.

Respectfully submitted,

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

3. (Amended) Apparatus according to [one of claims 1 and 2] claim 1, characterised in that, for an object of solid three-dimensional shape, the grid pattern chosen is tetrahedral, so that the computer is able to estimate the composition of the forces at each vertex of the tetrahedron, as a function of the deviation between the current length of each edge of the tetrahedron and the length of this edge at rest.

4. (Amended) Apparatus according to [one of the preceding claims] claim 1, characterised in that the computer is adapted to determine differences between the squares of the current length ( $l_j$ ) and the preceding length and/or the length at rest ( $L_j$ ) of each edge in order to determine said composition of forces.

5. (Amended) Apparatus according to [one of the preceding claims] claim 1, characterised in that the memory zone is adapted to store, in association with each mesh, mechanical parameters of the material of the mesh ( $\lambda_n, \mu_n$ ), at least partially defined locally, particularly at the level of the mesh or elements thereof.

8. (Amended) Apparatus according to [one of the preceding claims] claim 1, characterised in that it comprises a module for developing a data structure and adapted to delete mesh sides or edges ( $A_i$ ) which connect two so-called "virtual" vertices ( $S_i$ ).

10. (Amended) Apparatus according to [one of the preceding claims] claim 1, characterised in that the module (30, 32, 36) adapted to determine the new positional data of the vertices ( $Q^n$ ) as a function of the composition of forces at each vertex, is adapted to determine said new positional data as a function of time ( $E3$ ), which makes it possible to follow the evolution of the respective positions of the vertices over time.

12. (Amended) Apparatus according to [one of the preceding claims] claim 1, characterised in that the computer is capable of repeatedly determining the positional data of the vertices of the grid, with a view to determining the evolution of said positions over time ( $t + \Delta t$ ).

14. (Amended) Apparatus according to [one of the preceding claims] claim 1, characterised in that it comprises a user interface (IU) provided with a handling device (CLA, MO) for simulating one or more forces exerted globally on the subject.